

(Amended) 1. A method for performing an ion implantation comprising:

providing a target chamber for containing a target for implantation and an ion source chamber including an ion source for generating an ion beam;

disposing adjacent to said target chamber a beam deceleration optics that includes means for generating an off-axis electric field for decelerating and deflecting charged particles in said ion beam to project toward said target along a deflected angle away from neutralized particles in said ion beam.

(Amended) 2. The method of performing an ion implantation of claim 1 wherein:

disposing an analyzer magnet adjacent to said ion source chamber for mass filtering said ion beam.

(Amended) 3. The method of performing an ion implantation of claim 1 wherein:

said step of disposing said deceleration optics further comprising a step of disposing electrodes adjacent to said target chamber for generating said off-axis electrical field for decelerating and deflecting said charged particles in said ion beam.

(Amended) 4. The method of performing an ion implantation of claim 1 further comprising:

disposing said target on a target support and disposing said target support at an inclined angle whereby said target is perpendicular to said charged particles projected along said deflected angle.

(Amended) 5. The method of performing an ion implantation of claim 1 further comprising:

disposing a neutralized beam blocking means between said deceleration optics and said target wafer chamber for blocking said neutralized particle from reaching said target chamber.

(Amended) 6. The method of performing an ion implantation of claim 1 wherein:

said step of providing an ion source in an ion source chamber is a step of providing an ion source for generating a positive charged ion beam; and

said step of disposing said beam deceleration optics includes a step of disposing a means for generating a negative off-axis electric-field for decelerating and deflecting said charged particles in said ion beam.

(Amended) 7. The method of performing an ion implantation of claim 1 wherein:

said step of generating said off-axis electrical field for decelerating and deflecting said charged particles in said ion beam is a step of deflecting said charged particles at a small deflected angle relative to a projected direction of neutralized particles.

(Amended) 8. The method of performing an ion implantation of claim 7 wherein:

said step of decelerating and deflection said charged particles in said ion beam comprising a step of deflecting said ion beam at a small deflected angle in a range of three to fifteen degrees relative to a projection direction of said neutralized particles.

(Amended) 9. The method of performing an ion implantation of claim 1 wherein:

said step of providing said ion source in said ion source chamber comprising a step of providing said ion source chamber and said target chamber with a vacuum of approximately 10^{-5} Torr; and

said step of decelerating and deflecting said charged particles is a step of decelerating said ion beam to an energy level as low as about 200 eV with an energy contamination of less than about 0.1%.

(Amended) 10. A method for generating an implantation ion beam from an ion source projecting a plurality of ions comprising:

disposing a beam deceleration means adjacent to a target wafer of implantation for decelerating and deflecting charged particles away from neutralized particles in said ion beam to project decelerated and deflected charged particles to said target wafer of implantation.

(Amended) 11. The method of claim 10 further comprising:

arranging a wafer implant position with a small inclined angle relative to a projection direction of said neutralized particles corresponding to and substantially perpendicular to a projection direction of said charged particles for accepting said ions projected thereto.

(Amended) 12. The method of claim 10 further comprising:

disposing a blocking means between said decelerating means and said target wafer for blocking said neutralized particles from reaching said target of implantation.

(Amended) 13. The method of claim 10 wherein:

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said step of disposing said decelerating means further comprising a step of disposing electrodes adjacent to said target for generating an off-axis electric field for decelerating and deflecting said charged particles away from neutralized particles in said ion beam.

(Amended) 14. The method of claim 10 wherein:

said step of decelerating and deflecting said charged particles away from neutralized particles in said ion beam further comprising a step of decelerating and deflecting said charged particles into a high-aspect ratio beam having a large beam-height to beam-width ratio.

(Amended) 15. The method of claim 10 further comprising:

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disposing a beam block between said deceleration means and said target wafer for blocking said neutralized particles propagating in a neutralized-particle direction.

(Amended) 16. The method of claim 10 wherein:

said step of decelerating and deflecting said charged particles away from neutralized particles in said ion beam further comprising a step of decelerating and deflecting said charged particles into a high-aspect ratio beam and having a ratio of a beam height to a beam width equal or larger than 20.

(Amended) 17. The method of claim 16 wherein:

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said step of deflecting said charged particles into a high aspect-ratio beam having a ratio of a beam height to a height to a beam width equal or larger than 20 comprising a step of providing an extraction aperture for said ion source with an aspect ratio equal or larger than 20.

(Amended) 18. The method of claim 16 wherein:

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said step of deflecting said charged particles into a high aspect ratio beam having a large beam-height to beam-width ratio comprising a step of deflecting said charged particles into an ion beam having a beam-height to beam-width ratio equal or greater than 4.

(Amended) 19. The method of claim 18 wherein:

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said step of deflecting said charged particles into an ion beam having a beam-height to beam-width ratio equal or greater than 4 comprising a step of providing an aperture of said beam deceleration means having a beam-height to beam-width ratio equal or greater than 4.

(Amended) 20. The method of claim 13 wherein:

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said step of deflecting said charged particles away from neutralized particles comprising a step of deflecting said charged particles to project at an angle in the range of three to fifteen degrees relative to a projection direction of said neutralized particles.